PATENT SPECIFICATION

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Complete Accepted: Oct. 23, 1924.

COMPLETE SPECIFICATION.

Improvements in and relating to Centrifugal Compressors, Turbines and the like.

I, EMIL PEDER NORMAN, of Box 36, R.F.D. No. 1, Holmquist, Day County, South Dakota, United States of America, a citizen of the United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to improvements in compression or vacuum pumps and the like and has particular reference to a slow speed pump. The particular object of the invention is to provide a pump by means of which a high degree of compression or of vacuum may be obtained.

The preferred form of my invention is illustrated in the accompanying drawings in which Figure 1 shows a side elevation of my pump, Figure 2 a horizontal section through the same taken along line 2—2 of Figure 3, Figure 3 an end view of the same, Figure 4 a vertical section taken along line 4—4 of Figure 2, Figure 5 a sectional detail view illustrating an air-tight connection between two different chambers of my device, Figures 6, 7, 8, 9, 10 and 11, various modified forms of blades and blade arrangements to be used in connection with my pump, and Figures 12 and 13 detail views of a special wrench adapted to be used in connection with my device. While I have shown only the preferred form of the invention I wish to have it understood that various changes or modifications may be made within the scope of the claims hereto attached without departing from the spirit of the invention. I wish to call particular attention to the fact that while in the present application I have illustrated and described my device as a compression or vacuum pump, the same might be used with slight variations as a turbine, practically the only difference being that in a turbine a fluid medium would be forced past the blades so as to rotate the shaft, while in a pump a shaft is rotated in order to force the fluid medium past the blades.

My device which in this description will be referred to as a compression pump subject to the reservation made hereinabove, comprises a preferably cylindrical housing (1) resting on a base (2) which by means of bolts (3) may be secured to any suitable support. The housing is flanged internally at one end as shown at (4) to receive the end plate (6) and a plurality of propelling units from the other end, which latter thereupon is closed by means of the end plate (7) adapted to be tightened upon the cylindrical housing by means of nuts (8) engaging studs (9) extending from the latter. The end plate (7) is provided with an internal flange (11) adapted to bear against the stationary members (12) and to force the same in close contact with one another and with the flange (4) at the other end, while the rotary members (13) of the propelling units are adapted to be forced into the same direction by means of a nut (14) threadedly engaging the main central shaft (16) on which the rotary members (13) are supported with freedom of sliding motion but held against rotary motion by a key (17). Endwise motion of the shaft (16) itself is prevented in one direction by the member (18) threadedly engaging the shaft and bearing against the end plate (6), and in the opposite direction by the nut (23). It will be noticed that the member (18) as well as the nut (14) rotate with the shaft when the latter is set in motion by any suitable source of power through the clutch (19). The shaft rotates in bearing members (21), one of which threadedly engages the left end plate, (see Figure 2) while the other is slidably

held in the right end plate, balls (22) being interposed between the bearing members (21) which form the outer races of the bearings and the member (18) and a nut (23) on the left hand side, and the nuts (14) and (24) on the right hand side, which last mentioned members form the inner races of the bearings. The nut (14) is provided at its end with slots (26) allowing the same to be tightened by means of a specially designed wrench (27) shown in detail in Figures 12 and 13, and the same may be set by means of set screws (28). Oil may be introduced into the bearings through suitable passages (29).

The propelling means for my compressor comprises a plurality of rotary members (13) having discs (31) extending from hubs (32) alternating with stationary members (12) consisting of external rings (33) and annular tongues (34) extending into the spaces between the discs (31) so that a sinuous guideway is provided for the fluid medium allowing the latter to move in an axial direction only by following the curves of the guideway.

Motion is imparted to the fluid medium by means of blades (36) extending laterally from the faces of the discs. These blades are comparatively small and are disposed at an angle to a radial line. The blades may be designed in many different forms as shown in Figures 6 to 11 for different purposes. They are preferably arranged in concentric rings. They are curved slightly as shown in the drawing and the direction of their active faces depends upon whether they are supposed to force the fluid medium inwardly or outwardly.

Referring to a concrete example, as for instance, the arrangement shown in Figure 6, it will be seen that when the disc carrying the blades (36) is rotated in a clockwise direction the fluid medium such as air is engaged by the blades (36) and forced into a direction resulting from a combination of peripheral and radial motion. But now it is the intention of the present invention to force the fluid medium into a radial direction. For this purpose I space the rings or blades (36) a certain distance apart from one another and introduce a series of rings or blades (37) secured to the stationary tongues (34) which latter rings alternate with the rings of rotary blades (36). The fluid medium thrown by the rotary blades into a direction resulting from the combination of radial and circumferential motion impinges on the stationary blades (37) and is guided between the latter in radial direction until it is caught again by the rotary blades on the next ring. It is understood, of course, that the blades on one side of the discs are mounted to force the fluid medium inwardly while on the opposite side of the disc they are mounted to force the said medium outwardly.

It will be understood that the blades nearest the outer periphery of the discs move faster than the blades nearer the inner periphery and to compensate for this difference in speed, the blades nearer the inner periphery are set at a smaller angle relative to a radial line which gives them a tendency to move the fluid medium faster.

Further compensation for the difference in speed is furnished by the tapered form of the tongues by which the distance between the faces of the tongues and the faces of the discs increases toward the center allowing the blades to be correspondingly longer as they approach the center. The blades shown in Figure 6 and Figures 9, 10 and 11 are designed to be used in compression or vacuum pumps while the blades shown in Figures 7 and 8 are primarily designed for turbines.

Referring to Figure 2, it will be seen that my housing is divided into three different compartments by means of rotary partitions (38) formed substantially in the same manner as the end member (18) previously referred to. These partitions, one of which is shown in detail in Figure 5, are solid wheels with rather heavy hubs (39) and decreasing in thickness toward the periphery. They are provided on both surfaces with concentric ridges (41) of preferably rectangular cross section which are adapted to mesh with corresponding annular grooves (42) in the stationary members (43). The latter comprises rings (44) of substantially the same shape as the rings (33) previously mentioned and internal flanges (46) adapted to engage one face of the partition (38) and to be held in engagement by a second member (47) engaging the other face of the member (38) and bolted to the flange as shown at (48). It will be seen from the detail view of Figure 5 that the surrounding members (46) and (47) do not make a tight fit with the tapering wheel but leave small spaces (49) in the bottom of the grooves and at the top of the ridges adapted to receive a suitable packing as well as allowing of slight adjustment of the rotary member relative to the stationary member in a longitudinal direction.

It should be noted that the hubs of the discs as well as the rings surrounding the discs are provided with annular projections (51) engaging corresponding annular grooves in the adjacent member and leaving sufficient space in the bottom of

the grooves to allow of the introduction of packing as well as to allow of slight adjustment of the members relative to one another.

Referring to the general arrangement of Figure 2 which, of course, may be changed in many respects, it may be pointed out that the pipe (52) shown at the right hand side of the drawing connects with the fluid medium to be pumped, such as purified air or the like, and allows the same to be drawn directly into the two compartments (53) and (54), the communications with the latter compartment being brought about by the pipes (56). The air is propelled through the sinuous guideway by means of the blades in a manner described heretofore, and forced into the two outlet passages (57) and (58) communicating with the pipe (59) which latter connects by means not shown in the drawing with the pipe (61) allowing the air to enter the third compartment (61), which may be termed the high pressure side of my device from the opposite end.

It should be noted in this connection that in each compartment the discs decrease in diameter in the direction of the flow, thereby crowding the compressed air into small space and causing the same to move at high speed, it being understood, of course, that the blades actuating the air are designed to increase the speed as the end of the compartment is approached. In a similar manner is the third chamber designed to further increase the speed since in this chamber the air received from two compression chambers is crowded into one.

While passing from the pipe (59) to the pipe (61) the air may be cooled by appropriate means not shown in the drawing. After being forced through the high pressure side of the pump the air is finally discharged into the pipe (63) which connects with an air tank or any other suitable receptacle for the compressed air. It will be seen that in this arrangement the air on the high pressure side of the device travels in the opposite direction to that of the air on the low pressure side which eliminates end thrusts and causes the pump to be well balanced.

The operation of the device as well as the manner in which it is assembled should be readily understood from the foregoing description. To assemble the device the left hand plate (6) with the bearing member (21) in place and the end member (18) secured thereto is introduced from the right hand side (referring to Figure 2). The shaft may next be screwed into the member (18) whereupon the discs (13) may be introduced in alternating succession with the rings (12). After the first compartment is filled a partition is introduced in a similar manner whereupon the second compartment may be filled. The same process is repeated relative to the third compartment, care being taken that all the discs are properly engaged by the key on the shaft and that the spaces provided for the packing are properly filled. Now the end member (7) on the right hand side is presented over the studs (9) which for this purpose are made rather long, and forced toward the housing by means of the nuts (8). While the latter nuts are screwed down upon the studs the rings are forced slowly together and finally form a compact unit. The operation of forcing the rings together should be interrupted occasionally so that the nut (14) on the main shaft (16) may be tightened simultaneously by means of the left handed thread (20) whereby the hubs of the discs are forced together and toward the opposite end of the device in the same manner as the rings. Next the balls may be introduced and secured in place by means of the end nuts (23) and (24).

During the process of assembly the whole device is preferably turned over to rest on the left hand end having the internal flange (4). The insertion of the various intake and outlet pipes and connection of the same with the lead pipes completes the process.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a device of the character described, a cylindrical housing having an internal flange at one end, an end plate and a plurality of propelling units adapted to be pushed into the housing from the other end, and a second end plate adapted to be secured to the other end having means associated therewith for pushing the first end plates into contact with the internal flange and for pushing the propelling units toward said end plate.

2. In a device of the character described, a cylindrical housing having an internal flange at one end, an end plate adapted to be pushed against the flange from the other end, a shaft supported centrally in the housing, a plurality of discs supported on the shaft in spaced relation, a plurality of rings engaging the wall of the cylinder having annular tongues thereon extending into the spaces between the discs, the discs and the rings being adapted to be intro-

duced alternatingly, and a second end plate adapted to be secured to the other end having means associated therewith for pushing all the members within the housing toward the first mentioned end.

3. In a device of the character described, a cylindrical housing having an internal flange at one end, an end plate adapted to be pushed against the flange from the other end, a shaft supported centrally in the housing, a plurality of discs supported on the shaft in spaced relation, a plurality of rings engaging the wall of the cylinder having annular tongues thereon extending into the spaces between the discs, the discs and the rings being adapted to be introduced alternatingly, and a second end plate adapted to be secured to the other end having means associated therewith for pushing all the members within the housing toward the first mentioned end. separating units being introduced for dividing the housing into several chambers.

Dated the 14th day of January, 1924.

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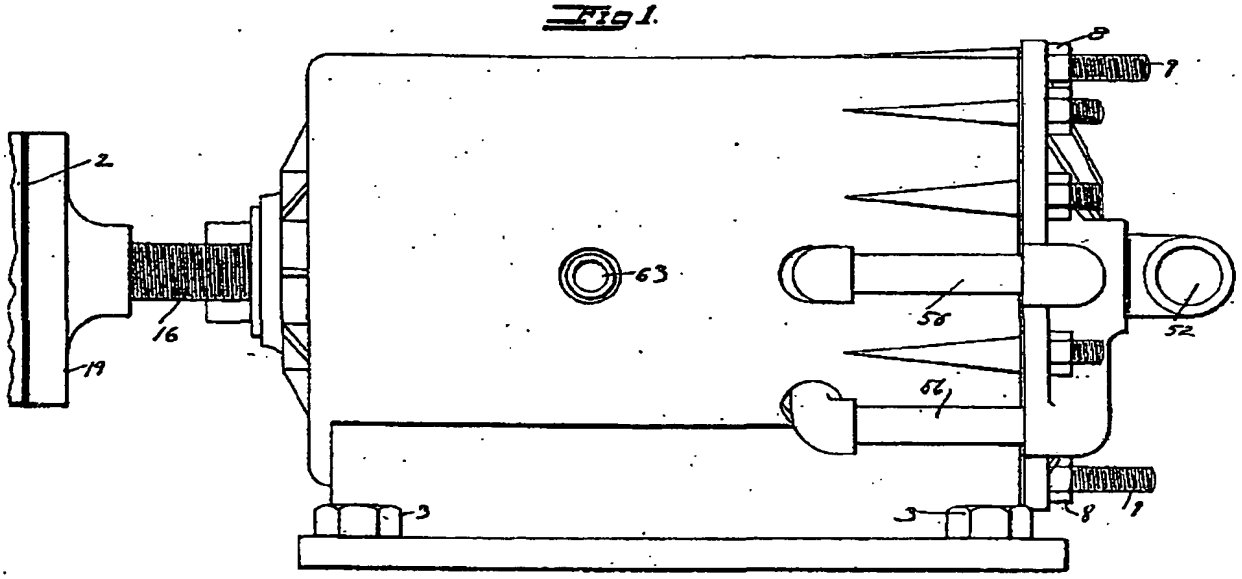
Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1924.

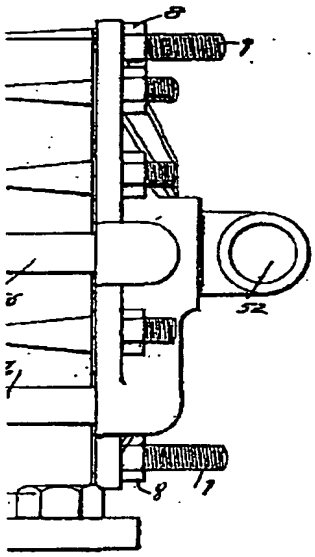
[This Drawing is a reproduction of the Original on a reduced scale]

Fig 1.



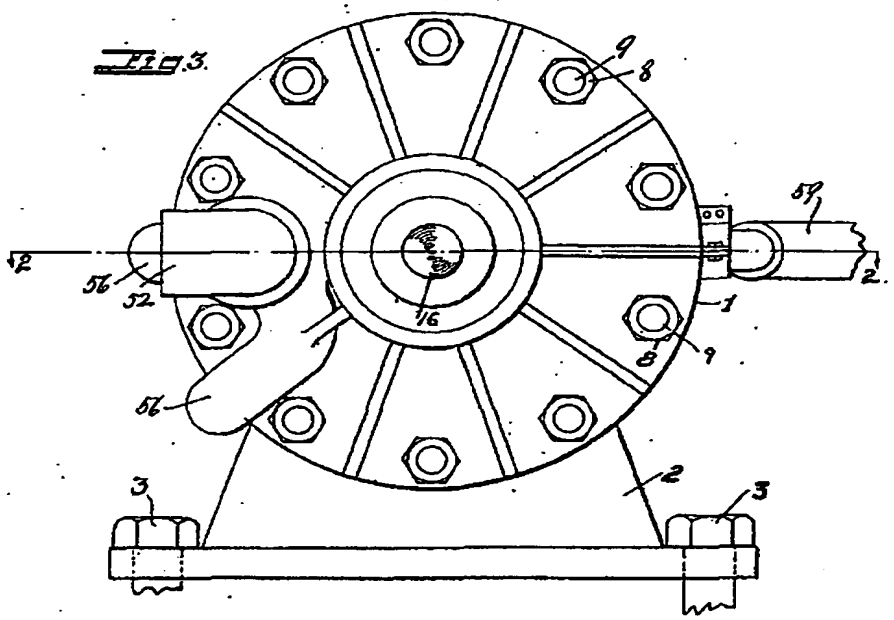
4 SHEETS

SHEET 1



SHEET 3

Fig 3.



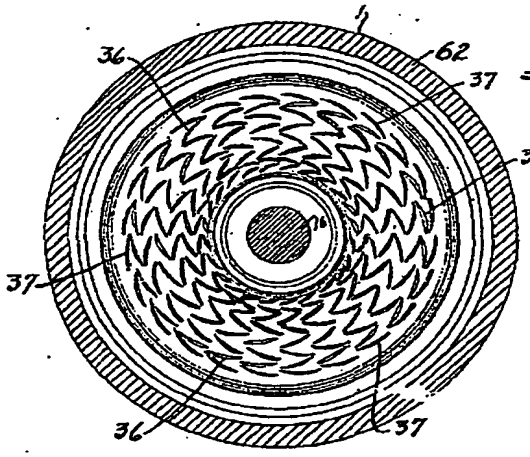


Fig 4

Fig 12.

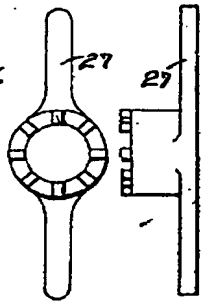


Fig 13.

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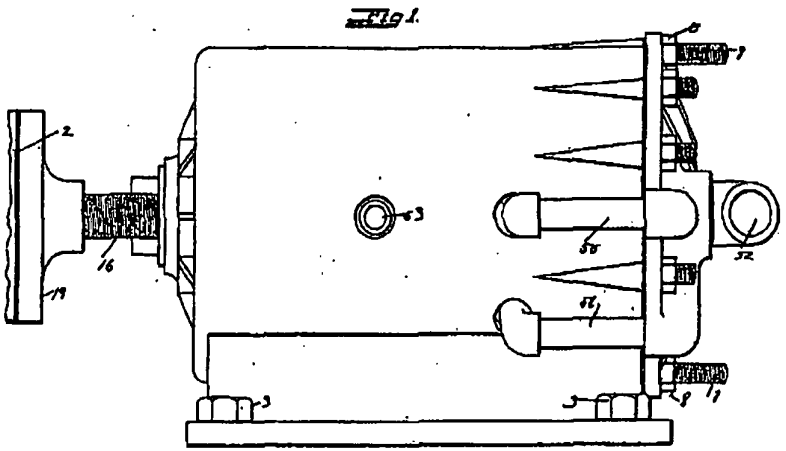
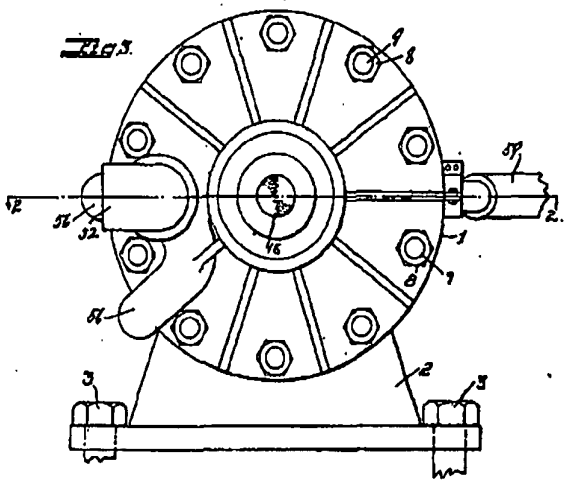
SHEET 1

Fig 1.



SHEET 3

Fig 3.



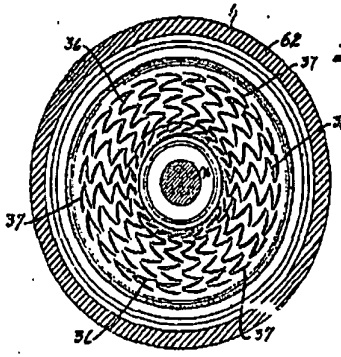


Fig 4

Fig 12.

Fig 13

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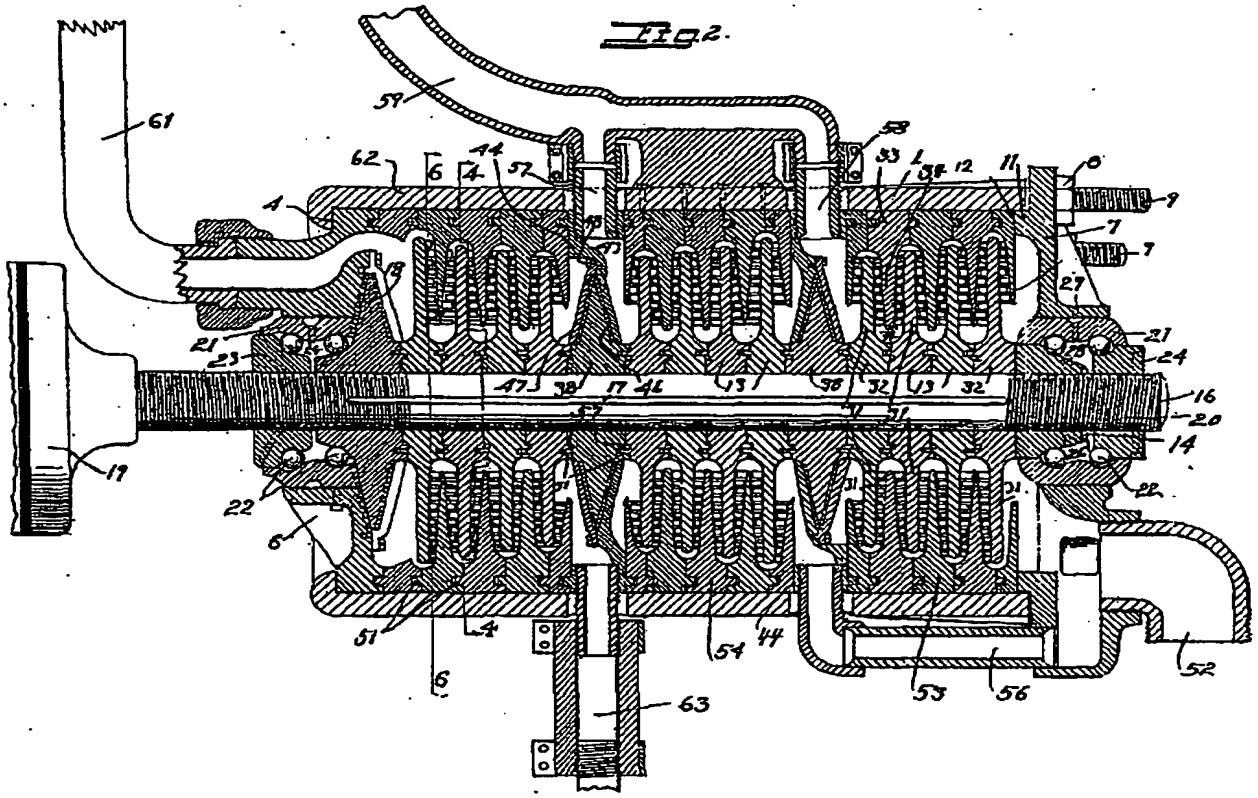
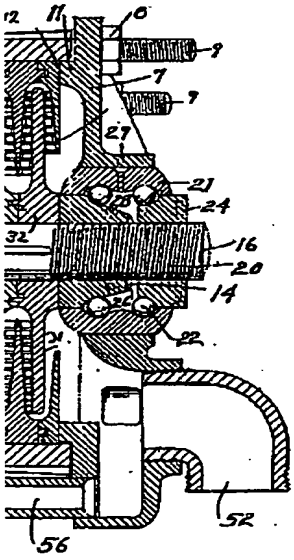
[This Drawing is a reproduction of the Original on a reduced scale.]

Fig 2.



SHEET 2



SHEET 4

Fig 5

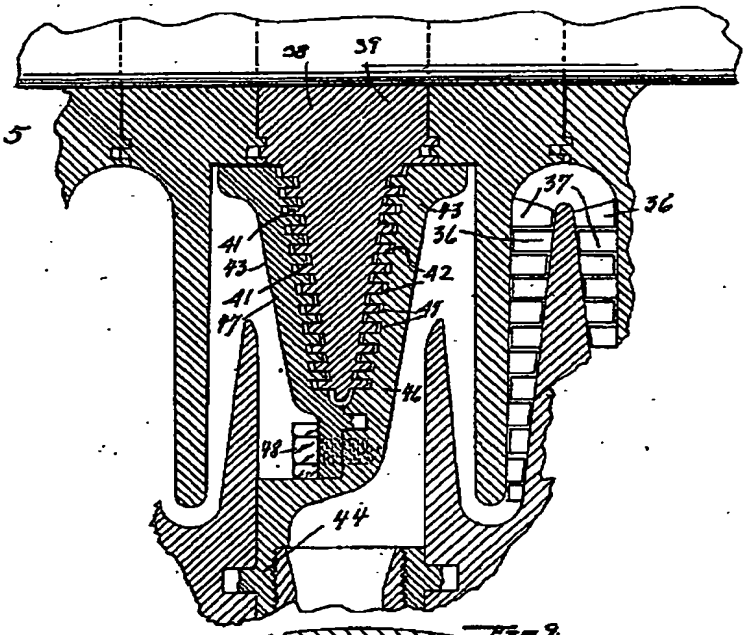


Fig 8

Fig 9

Fig 7.

Fig 10

Fig 11

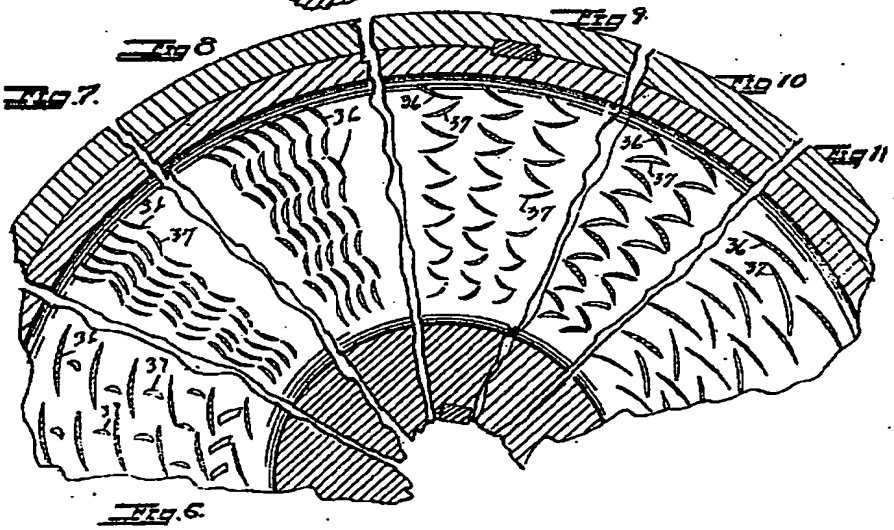


Fig. 6.

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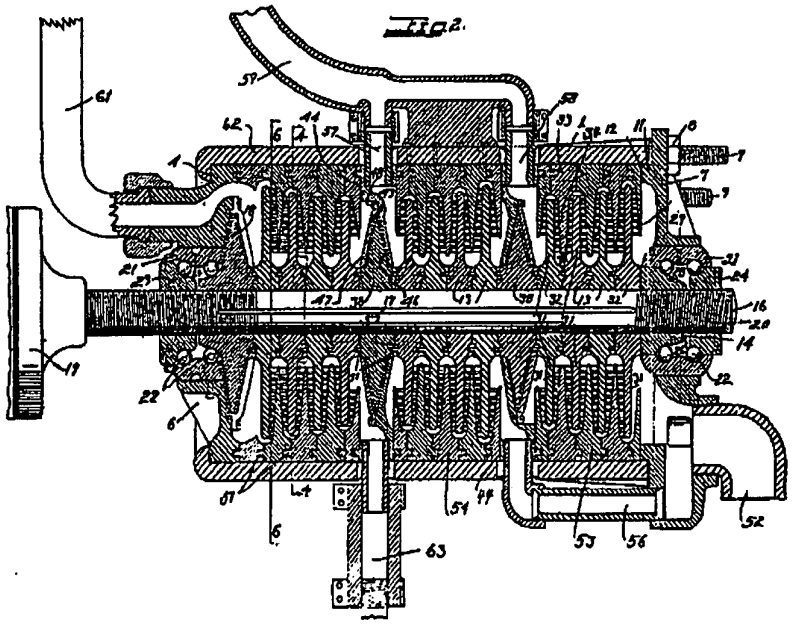
4 SHEETS

SHEET 3



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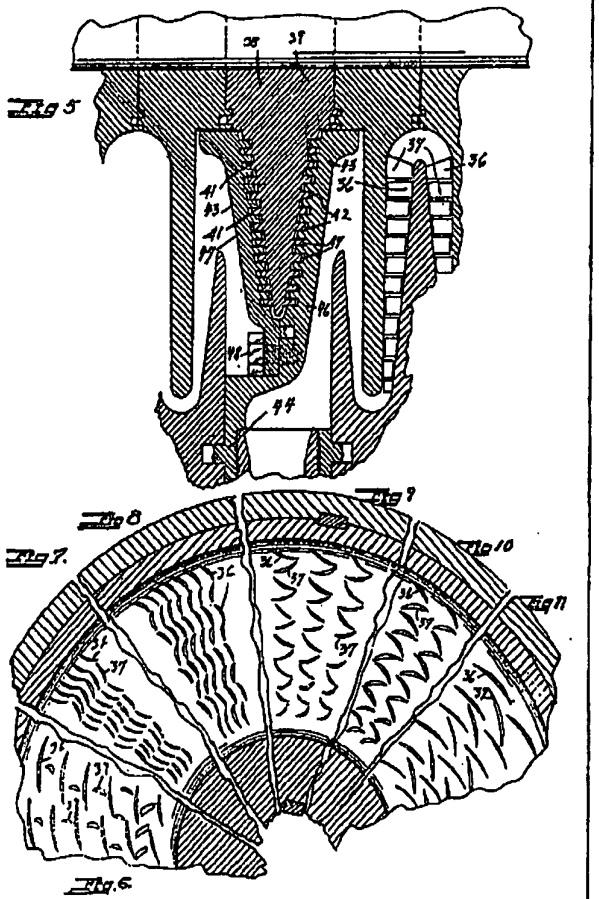

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